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NEW UTILITY PATENT APPLICATION TRANSMITTAL
(Large Entity)

(Only for new nonprovisional applications under 37 CFR 1.53(b))

Docket No. 47,958
Total Pages in this Submission 21

JC561 U.S. PTO 01/13/98

TO THE ASSISTANT COMMISSIONER FOR PATENTS
Box Patent Application
Washington, D.C. 20231

Transmitted herewith for filing under 35 U.S.C. 111(a) and 37 C.F.R. 1.53(b) is a new utility patent application for an invention entitled:

Virtual Keyboard

and invented by:

Katsuya Nakagawa

If a CONTINUATION APPLICATION, *check appropriate box and supply the requisite information:*

☐ **Continuation** ☐ **Divisional** ☐ **Continuation-in-part (CIP)** of prior application No.: _____

Enclosed are:

Application Elements

1. ☒ Filing fee as calculated and transmitted as described below

2. ☒ Specification having **15 (including cover sheet)** pages and including the following:

   a. ☒ Descriptive Title of the Invention
   b. ☐ Cross References to Related Applications *(if applicable)*
   c. ☐ Statement Regarding Federally-sponsored Research/Development *(if applicable)*
   d. ☐ Reference to Microfiche Appendix *(if applicable)*
   e. ☒ Background of the Invention
   f. ☒ Brief Summary of the Invention
   g. ☒ Brief Description of the Drawings *(if drawings filed)*
   h. ☐ Detailed Description
   i. ☒ Claim(s) as Classified Below
   j. ☒ Abstract of the Disclosure

3. ☒ Drawing(s) *(when necessary as prescribed by 35 USC 113)*

   a. ☒ Formal
   b. ☐ Informal

   Number of Sheets **6**

NEW UTILITY PATENT APPLICATION TRANSMITTAL
(Large Entity)

(Only for new nonprovisional applications under 37 CFR 1.53(b))

Docket No. 47,958
Total Pages in this Submission 21

Application Elements (Continued)

4. ☒ Oath or Declaration
   a. ☐ Newly executed *(original or copy)* ☐ Unexecuted
   b. ☐ Copy from a prior application (37 CFR 1.63(d)) *(for continuation/divisional application only)*
   c. ☒ With Power of Attorney ☐ Without Power of Attorney

5. ☐ Incorporation By Reference *(usable if Box 4b is checked)*
   The entire disclosure of the prior application, from which a copy of the oath or declaration is supplied under Box 4b, is considered as being part of the disclosure of the accompanying application and is hereby incorporated by reference therein.

6. ☐ Computer Program in Microfiche *(Appendix)*

7. ☐ Nucleotide and/or Amino Acid Sequence Submission *(if applicable, all must be included)*
   a. ☐ Paper Copy
   b. ☐ Computer Readable Copy *(identical to computer copy)*
   c. ☐ Statement Verifying Identical Paper and Computer Readable Copy

Accompanying Application Parts

8. ☒ Assignment Papers *(cover sheet & document(s))*

9. ☐ 37 CFR 3.73(B) Statement *(when there is an assignee)*

10. ☐ English Translation Document *(if applicable)*

11. ☐ Information Disclosure Statement/PTO-1449 ☐ Copies of IDS Citations

12. ☐ Preliminary Amendment

13. ☒ Acknowledgment postcard

14. ☒ Certificate of Mailing
    ☐ First Class ☒ Express Mail *(Specify Label No.):* **TB553891987US**

15. ☒ Certified Copy of Priority Document(s) *(if foreign priority is claimed)*

NEW UTILITY PATENT APPLICATION TRANSMITTAL
(Large Entity)

(Only for new nonprovisional applications under 37 CFR 1.53(b))

Docket No.
47,958
Total Pages in this Submission
21

Accompanying Application Parts (Continued)

16. ☐ Additional Enclosures *(please identify below):*

Fee Calculation and Transmittal

CLAIMS AS FILED

For	#Filed	#Allowed	#Extra		Rate	Fee
Total Claims	2	- 20 =	0	x	$22.00	$0.00
Indep. Claims	1	- 3 =	0	x	$82.00	$0.00
Multiple Dependent Claims (check if applicable) ☐						$0.00
					BASIC FEE	$790.00
OTHER FEE ***(specify purpose)***		**Recordal of Assignment**				$40.00
					TOTAL FILING FEE	$830.00

☒ A check in the amount of **$830.00** to cover the filing fee is enclosed.

☒ The Commissioner is hereby authorized to charge and credit Deposit Account No. **04-1105** as described below. A duplicate copy of this sheet is enclosed.

- ☐ Charge the amount of as filing fee.
- ☒ Credit any overpayment.
- ☒ Charge any additional filing fees required under 37 C.F.R. 1.16 and 1.17.
- ☐ Charge the issue fee set in 37 C.F.R. 1.18 at the mailing of the Notice of Allowance, pursuant to 37 C.F.R. 1.311(b).

Dated: Jan 13, 99

Signature

David G. Conlin, Esq. (27,026)
Dike, Bronstein, Roberts & Cushman, LLP
130 Water Street
Boston, MA 02109
Tel.: (617) 523-3400

cc:

CERTIFICATE OF MAILING BY "EXPRESS MAIL" (37 CFR 1.10) Applicant(s): K. Nakagawa	Docket No. 47,958

Serial No.	Filing Date	Examiner	Group Art Unit
not yet assigned	none		

Invention: **Virtual Keyboard**

I hereby certify that this **New Utility Patent Application Transmittal (Large Entity)**
(Identify type of correspondence)

is being deposited with the United States Postal Service "Express Mail Post Office to Addressee" service under 37 CFR 1.10 in an envelope addressed to: The Commissioner of Patents and Trademarks, Washington, D.C. 20231-0001 on Jan. 13, 1998
(Date)

KATHY THOMAS
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(Signature of Person Mailing Correspondence)

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PATENT
Case No.: 47,958
Express Mail #TB553891987US

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
APPLICATION FOR UNITED STATES LETTERS PATENT

INVENTOR(S): KATUSYA NAKAGAWA

TITLE: VIRTUAL KEYBOARD

ATTORNEY: David G. Conlin, Esq.
Dike, Bronstein, Roberts & Cushman, LLP
130 Water Street
Boston, MA 02109
617-523-3400

DOCKET NO. 47958

VIRTUAL KEYBOARD

BACKGROUND OF THE INVENTION

The present invention relates to an input device and more particularly to a keyboard displayed on a display screen, which keyboard is hereinafter referred to as virtual keyboard.

On a conventional keyboard, one may input a capital character (alphabet) by pushing down on a Shift-key first and then keeping the shift key in the pushed state, pushing and releasing a desired character key. After this, one releases the shift key.

On the other hand, a virtual keyboard works for determining a character key of a keyboard presented on a display screen by comparing position information received from an output of a transparent pressure (touch)-sensitive panel disposed on the display screen with position information of keys of the keyboard presented on the display screen and outputting a character indicated on a corresponding character key.

Accordingly, on the virtual keyboard, any small character (alphabet) is input by pushing a corresponding key of the keyboard indicated on the display screen and any capital character is input in a shift mode, namely, by pushing a shift key first and a

corresponding character key next. In practice of inputting a capital character (e.g., "I"), one must push and release the shift key to change over the input mode to Capital input mode, must push and release the key <I> to input the character "I" and, then, must push and release the shift key again to release the Capital input mode.

On the above-described virtual keyboard, however, the number of push-and-release operations is larger than by one on the conventional keyboard. This is inconvenient and unpleasant for those who have been familiar to the conventional keyboard.

SUMMARY OF THE INVENTION

Main object of the present invention is to provide a virtual keyboard which can be used like a conventional keyboard, allowing a user natural inputting operation with a reduced operation load.

A virtual keyboard according to the present invention is featured in that it is composed of a display means for displaying a keyboard, a transparent pressure(touch)-sensitive panel disposed on the display means and a processing means for receiving information of positions detected and sent in a time sequence from the pressure(touch)-sensitive panel when a combination

of a general key and a special key in the keyboard is pushed at a time, identifying a position of the pushed general key according to the received position information and outputting a code corresponding to the pushed combination of the special key and the general key.

Another virtual keyboard according to the present invention has the same construction as the above-mentioned virtual keyboard and is further featured in that one of the received position information is a middle position between the pushed positions being selected as a furthest position from the special key in the information of positions detected in a time sequence and the position of the general key is determined by doubling a distance from the special key to the furthest position.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 shows a structure of a pressure-sensitive panel.

Fig. 2A shows an equivalent circuit for detecting a position in the X-axis direction when a push is made at one point on a pressure-sensitive panel.

Fig. 2B shows an equivalent circuit for detecting a position in the Y-axis direction when a push is made at

one point on a pressure-sensitive panel.

Fig. 3 shows an equivalent circuit for detecting a position in the X-axis direction when two points on a pressure-sensitive panel are pushed at a time.

Fig. 4 shows a basic construction of an embodiment of the present invention.

Fig. 5 is a view for explaining an input processing action of an embodiment of the present invention.

Fig. 6 is a flow chart depicting the operation of an embodiment of the present invention.

Fig. 7 is illustrative of an aspect of the present invention when it is applied to a portable type information terminal.

PREFERRED EMBODIMENTS OF THE INVENTION

A pressure(touch)-sensitive panel used in a virtual keyboard of the present invention is similar in structure to a prior art pressure-sensitive panel and will be first and briefly described below:

Fig. 1 shows, by way of example, a film resistance type analog pressure-sensitive panel which comprises a large number, from several hundreds to several thousands, of transparent resistance wires 10 densely arranged along the X-axis and Y-axis thereof respectively and two pair of electrodes 11 for

generating an output when any area of the pressure-sensitive touch panel is pushed down there on.

Referring to Fig. 2, the operation principle of the pressure-sensitive panel is described below:

When a pressure was applied to a point 20 on the pressure-sensitive panel, two resistance wires in the X-direction and Y-direction conduct at the point 20 as shown in Fig. 2A. At this time, a voltage V0 is applied across terminal electrode pair in the X-axis direction, so an output of V0vRX2/(RX1+RX2) is obtained across terminal electrode pair at both ends of the wire in the Y-axis direction. The output value corresponding to a divided resistance is amplified to determine a position of the point 20 in the X-axis direction. Similarly, a position of the point 20 in the Y-axis direction is determined by applying a voltage V0 across terminal electrode pair in the direction Y as shown in Fig. 2B. Usually, the pressure-sensitive panel conducts sampling of position values of a point pushed down on in the X-direction and Y-direction by momentarily changing the state of Fig. 2A to the state of Fig. 2B and reverse.

Fig. 3 shows the pressure-sensitive panel when detecting positions of two points pushed down thereon in the X-axis direction. As shown in Fig. 3, a voltage obtained across electrodes in the Y-axis direction is

an average output of two pushed points, which corresponds to a substantially middle position between the two pushed points in the X-axis direction. Similarly, an output corresponding to a substantially middle position between the two pushed points in the Y-axis direction can be obtained. The present invention is intended to enable a virtual keyboard to be operated easily like a conventional keyboard, utilizing the above-mentioned unique characteristic of the pressure-sensitive panel that outputs a substantially middle position between two points pushed down thereon.

Fig. 4 shows a basic construction of a virtual keyboard embodying the present invention. This embodiment comprises a liquid-crystal display (LCD) 1, a keyboard image 2 displayed on the liquid-crystal display 1, a transparent pressure-sensitive panel 3 superimposed on the liquid-crystal display 1 to detect which key position or combination of key positions of the keyboard image 2 are pushed, and a computing portion 4 for controlling the liquid-crystal display 1 connected thereto and the pressure-sensitive panel 3 connected thereto and determining, when two positions on the keyboard image 2 are pushed down on at the same time, and specifying the key to be output by performing calculating operations to be described later. The keyboard image 2 is identical to that of a conventional

keyboard and has alphabetical character keys each of which carries thereon a small and a capital character as shown in an enlarged view in Fig. 4. The pressure-sensitive panel 3 is the before-described type pressure-sensitive panel.

The computing portion 4 holds coordinate areas corresponding to areas of respective keys of the keyboard image 2 in a coordinate system of the pressure-sensitive panel. Namely, the computing portion 4 has a memory (not shown) in which coordinate data of respective unit areas (keys of the keyboard image 2) in the coordinate pressure-sensitive panel and codes corresponding to said coordinate data. When any key of the keyboard image 2 was pushed, the computing portion 4 detects the pushed position by sampling outputs of the pressure-sensitive panel 3, identifies the pushed key by comparing the detected position with stored coordinate data and generates the corresponding code.

Referring to Fig. 5, the operation of a virtual keyboard according to the present invention will be described bellow:

In Fig. 5, there is shown ANK (alphabetical character and numeral etc.) key 51 of the keyboard image 2 that is hereinafter referred to as a general key. When any general key was pushed down on, the

computing portion 4 conducts the above-mentioned operations and generates a corresponding code. In practice, a user can input, e.g., a small alphabetical letter "i" by pushing down on a general key 51 indicated with a letter "i". In this case, the small letter "i" is generated as far as the detected position lies within a coordinate area of the general key 51. This operation is the same as that of the conventional keyboard.

The operation of the virtual keyboard when detected that a general key and a special key (e.g., a shift-key, control-key or front-key) are pushed at a time is as follows:

When a user wants to input a capital alphabetical letter, e.g., "I", he or she pushes a special (<shift>) key 52 and pushes, keeping the shift key as pushed, a general (<I>) key 51 (the same key used for inputting a small letter "i"). In this instance, the computing portion 4 detects that two keys were pushed at a time, specifies the position of the pushed general key 51 by conducting processing operations (to be described later), judges that the capital letter "I" was input in this case, and generates a corresponding code. The computing portion 4, of course, has in its memory coordinate-data of areas of two simultaneously pushed keys and corresponding codes.

In this case, a user pushes a position 53 in a coordinate area of the special (<shift>) key 52 and, keeping the special key in the pushed state, pushes a position 54 in a coordinate area of the general character <i> key 51, then releases the push from the position 54 (general key 51) and the position 53 (special key 52). Output of the pressure-sensitive panel is sampled at a frequency of 100 to 200 times per second. Consequently, information of the detected positions represents a trace 56 which starts from a position 53, reaches a position 55 being a middle point between the start position 53 and the position 54 and returns therefrom to the start position 53. The position 53 is fixed by the coordinate (X1, Y1) and the position 55 is fixed by the coordinate (X2, Y2). The computing portion 4 detects these coordinates and calculates the coordinate (Xn, Yn) of the position 54 according to the following equations:

$$Xn = 2X2 - X1$$

$$Yn = 2Y2 - Y1$$

Namely, it is determined that the capital letter "I" was input, if the calculated coordinate (Xn, Yn) is within a coordinate area of a general key 51.

Thus, pushing a special key first and a general key next generates a trace of pushed positions, which starts from a coordinate area of the special key, turns

at a certain point and terminates in the same coordinate area of the same special key. Consequently, the position of the general key pushed together with the special key can be determined by calculating a doubled vector from the start point to the turning point (a middle position between pushed positions). The inputting operation can be thus performed just like on the conventional keyboard. The display means may display character corresponding to a code generated.

Referring to Fig. 6, the inputting operation of the virtual keyboard is described as follows:

A pushed position is detected first from the output of the pressure-sensitive panel (Step 1). Next, the detected position is judged whether it lies within an area of general keys. If so, a corresponding character is generated (Step 2 and 3).

The detected position being outside the area of general keys is further checked whether it lies within an area of special keys (Step 4). Nothing is done if the position is outside the area of the special keys (Step 5). If the detected position exists within the area of special keys, a trace of subsequently outputted position information (in the unstable state) is calculated and a turning point of the trace (a middle position between the pushed positions, in a sense) is determined (Step 6). In this embodiment, a furthest of

subsequently detected points from the starting point is detected as the turning point.

A segment from the start point to the turning point is doubled to determine a corresponding position (Step 7) and a character code corresponding to the general key of the determined position is generated in the shift mode (capital input mode)(Step 8).

Fig. 7 shows another embodiment of the present invention, which is applied in a keyboardless portable type information terminal. A liquid-crystal display 1, a pressure-sensitive panel and a computing portion 4 are all built in a single solid body. This device is similar to the embodiment described with reference to Fig. 4, excepting that the liquid-crystal display 1 can display thereon characters input through a keyboard image 2 presented thereon.

Although the foregoing embodiments of the present invention have alphabetical keys, it is also possible to apply the present invention to a keyboard can generate plural kinds of characters from each of the general keys by using it in combination with a special key.

According to the present invention, it is possible to provide a virtual keyboard which can work just like a conventional keyboard, allowing a user to naturally conduct input operations with a minimized operation

load.

Document Retrieved from www.dtic.mil

CLAIMS

1. A virtual keyboard comprising a displays for displaying a keyboard, a transparent pressure-sensitive panel disposed on the displays and a processor for receiving information of positions detected and sent in a time sequence from the pressure-sensitive panel when a combination of a general key and a special key in the keyboard is pushed at a time, identifying a position of the pushed general key according to the received position information and outputting a code corresponding to the pushed combination of the special key and the general key.

2. A virtual keyboard as defined in claim 1, wherein one of the received position information is a middle position between the pushed positions being selected as a furthest position from the special key in the information of positions detected in a time sequence and the position of the general key is determined by doubling a distance from the special key to the furthest position.

ABSTRACT

The present invention provides virtual keyboard which can be used at the same number of operations as on a conventional keyboard and can allow a natural input operation at a minimized load. The virtual keyboard comprises a liquid crystal display for displaying thereon a keyboard having special keys and general keys, a transparent pressure-sensitive panel superimposed on the display and a computing portion that, when a special key and a general key on a pressure-sensitive panel are pushed at a time, detects the coordinate of a middle point between the two pushed positions from outputs of the pressure-sensitive panel, calculates a general key position from the special key point and the middle point and outputs a code corresponding to that position.

Document Page 14 of 16

DIKE, BRONSTEIN, ROBERTS & CUSHMAN, LLP
130 Water Street
Boston, Massachusetts 02109

Attorney's Docket No. _____

DECLARATION AND POWER OF ATTORNEY

As a below named inventor, I hereby declare that: My residence, post office address and citizenship are as stated below next to my name. I believe I am the original, first and sole inventor (if only one name is listed at 201) below or an original, first and joint inventor (if plural names are listed at 201-208 below) of the subject matter which is claimed and for which a patent is sought on the invention entitled:

VIRTUAL KEYBOARD

which is described and claimed in:

☐ the specification attached hereto.

☐ the specification in U.S. Application Serial Number _____, filed on _____.

☐ the specification in PCT international application Number _____, filed on _____; and was amended on _____.

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment referred to above. I acknowledge the duty to disclose information which is material to the examination of this application in accordance with Title 37, Code of Federal Regulations, §1.56(a). I hereby claim foreign priority benefits under Title 35, United States Code, §119 of any foreign application(s) for patent or inventor's certificate listed below and have also identified below any foreign application for patent or inventor's certificate having a filing date before that of the application on which priority is claimed.

Prior Foreign/PCT Applications and Any Priority Claims Under 35 U.S.C. 119:			
Application No.	**Filing Date**	**Country**	**Priority Claimed Under 35 U.S.C. 119?**
9-035919	20th, February, 1997	JAPAN	☒YES ☐NO
			☐YES ☐NO
			☐YES ☐NO
			☐YES ☐NO
			☐YES ☐NO
			☐YES ☐NO
			☐YES ☐NO

I hereby claim the benefit under 35 U.S.C. §120 of any United States application(s) or PCT international application(s) designating the United States of America that is/are listed below, and, insofar as the subject matter of each of the claims of this application is not disclosed in that/those prior application(s) in the manner provided by the first paragraph of 35 U.S.C. §112, I acknowledge the duty to disclose material information as defined in 37 CFR §1.56(a) which occurred between the filing date of the prior application(s) and the national or PCT international filing date of this application:

Prior U.S. Applications or PCT International Applications Designating the U.S-Benefit Under 35 U.S.C. §120					
U.S. Applications			Status (Check One)		
Application Serial No.		U.S. Filing Date	Patented	Pending	Abandoned
PCT Applications Designating the U.S.					
Application No.	Filing Date	U.S. Serial No. Assigned			

CLAIM FOR BENEFIT OF PRIOR U.S. PROVISIONAL APPLICATION(S) (35 U.S.C. § 119(e))

I hereby claim the benefit under Title 35, United States Code, §119(e) of any United States provisional application(s) listed below:

Applicant	Provisional Application Number	Filing Date

POWER OF ATTORNEY: As a named inventor, I hereby appoint the following attorney(s) with full powers of association, substitution and revocation to prosecute this application and transact all business in the Patent and Trademark Office connected therewith.

Sewall P. Bronstein	(Reg. No. 16,919)	Linda M. Buckley	(Reg. No. 31,003)	David S. Resnick	(Reg. No. 34,235)
David G. Conlin	(Reg. No. 27,026)	Ronald I. Eisenstein	(Reg. No. 30,628)	Peter F. Corless	(Reg. No. 33,860)
George W. Neuner	(Reg. No. 26,964)	Henry D. Pahl, Jr.	(Reg. No. 20,438)		
Ernest V. Linek	(Reg. No. 29,822)	Peter J. Manus	(Reg. No. 26,766)		

Docket #: 2003.0

SEND CORRESPONDENCE TO:	DIRECT TELEPHONE CALLS TO:
Dike, Bronstein, Roberts & Cushman, LLP 130 Water Street Boston, Massachusetts 02109	(617) 523-3400

201	FULL NAME OF INVENTOR	LAST NAME NAKAGAWA	FIRST NAME Katsuya	MIDDLE NAME
	RESIDENCE & CITIZENSHIP	CITY Nara-shi	STATE OR FOREIGN COUNTRY NARA, JAPAN	COUNTRY OF CITIZENSHIP JAPAN
	POST OFFICE ADDRESS	POST OFFICE ADDRESS 45-3 Takama-cho	CITY Nara-shi	STATE OR COUNTRY AND ZIP CODE NARA, JAPAN, 630

202	FULL NAME OF INVENTOR	LAST NAME	FIRST NAME	MIDDLE NAME
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	POST OFFICE ADDRESS	POST OFFICE ADDRESS	CITY	STATE OR COUNTRY AND ZIP CODE

203	FULL NAME OF INVENTOR	LAST NAME	FIRST NAME	MIDDLE NAME
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	POST OFFICE ADDRESS	POST OFFICE ADDRESS	CITY	STATE OR COUNTRY AND ZIP CODE

204	FULL NAME OF INVENTOR	LAST NAME	FIRST NAME	MIDDLE NAME
	RESIDENCE & CITIZENSHIP	CITY	STATE OR FOREIGN COUNTRY	COUNTRY OF CITIZENSHIP
	POST OFFICE ADDRESS	POST OFFICE ADDRESS	CITY	STATE OR COUNTRY AND ZIP CODE

Docket No. 2003-0538

205	FULL NAME OF INVENTOR	LAST NAME	FIRST NAME	MIDDLE NAME
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	POST OFFICE ADDRESS	POST OFFICE ADDRESS	CITY	STATE OR COUNTRY AND ZIP CODE

206	FULL NAME OF INVENTOR	LAST NAME	FIRST NAME	MIDDLE NAME
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	POST OFFICE ADDRESS	POST OFFICE ADDRESS	CITY	STATE OR COUNTRY AND ZIP CODE

207	FULL NAME OF INVENTOR	LAST NAME	FIRST NAME	MIDDLE NAME
	RESIDENCE & CITIZENSHIP	CITY	STATE OR FOREIGN COUNTRY	COUNTRY OF CITIZENSHIP
	POST OFFICE ADDRESS	POST OFFICE ADDRESS	CITY	STATE OR COUNTRY AND ZIP CODE

208	FULL NAME OF INVENTOR	LAST NAME	FIRST NAME	MIDDLE NAME
	RESIDENCE & CITIZENSHIP	CITY	STATE OR FOREIGN COUNTRY	COUNTRY OF CITIZENSHIP
	POST OFFICE ADDRESS	POST OFFICE ADDRESS	CITY	STATE OR COUNTRY AND ZIP CODE

I hereby further declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further, that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Signature of Inventor 201	Signature of Inventor 202
Katsuya Nakagawa	
Date: 4th, Dec, 1997 ~~20th, February, 1998~~ K.N	Date:

#

FIG.1

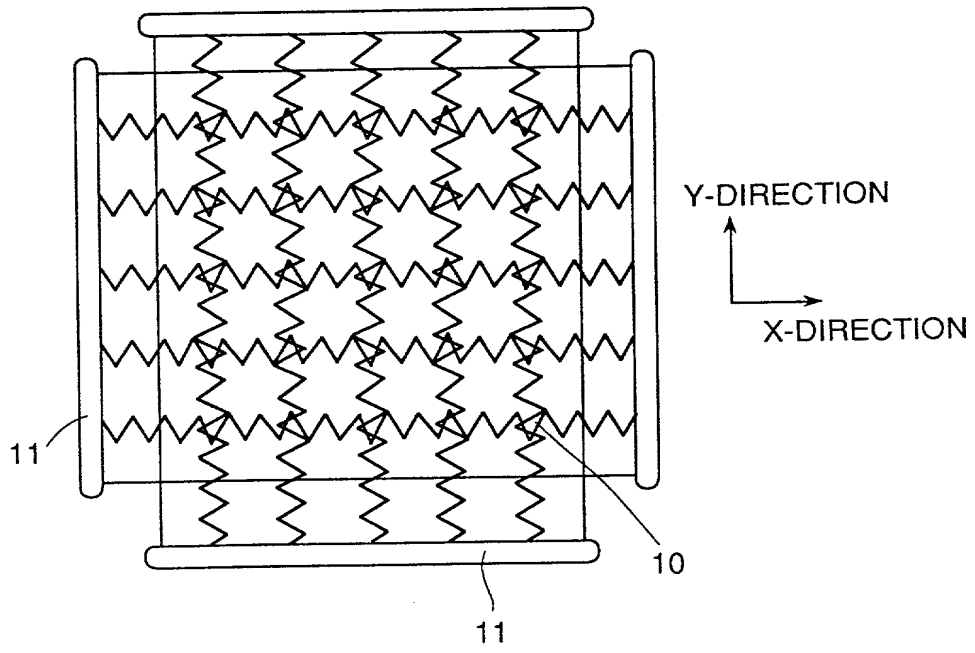


FIG.2A

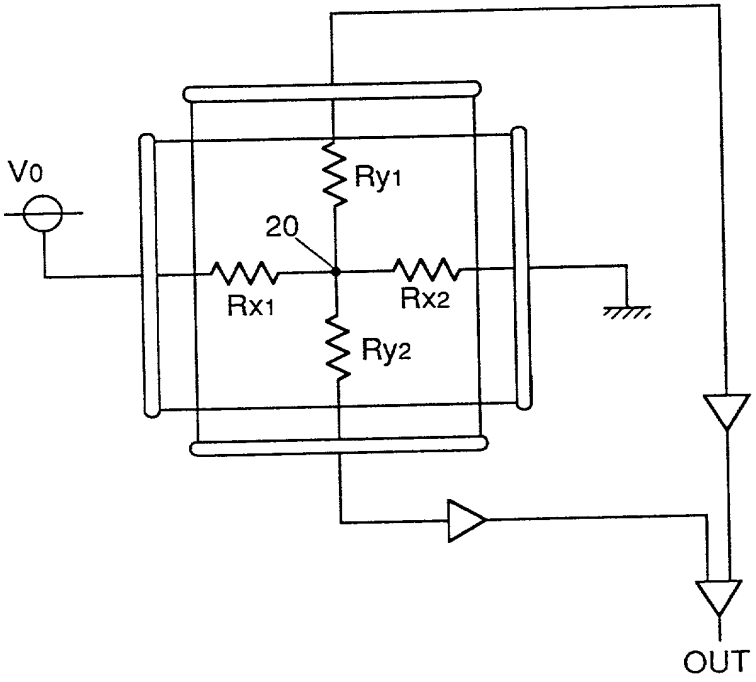


FIG.2B

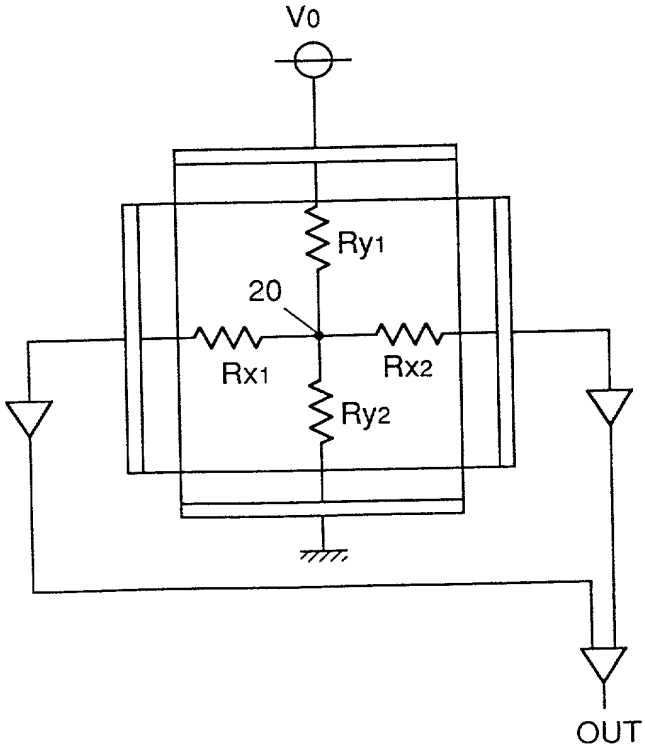


FIG.3

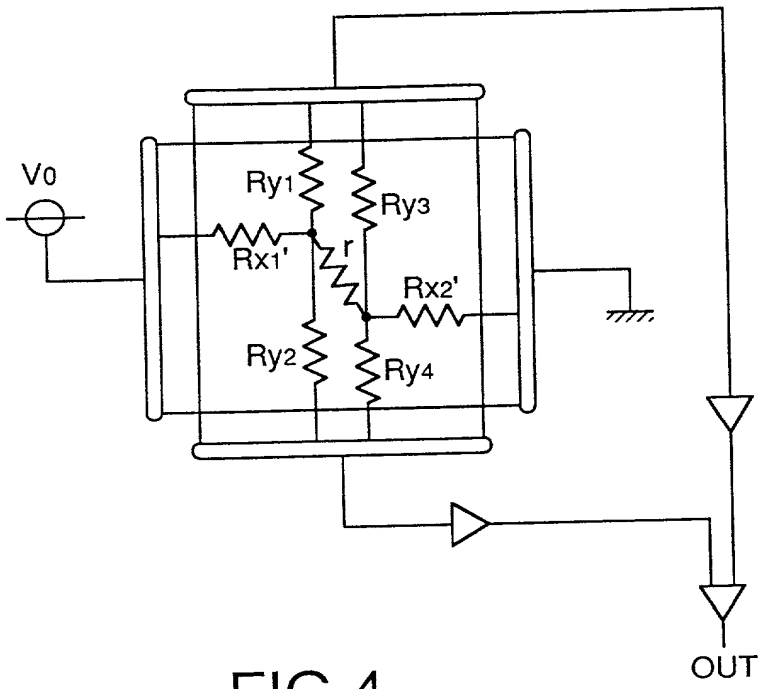

V0
Ry1
Ry3
Rx1'
r
Rx2'
Ry2
Ry4
OUT

FIG.4

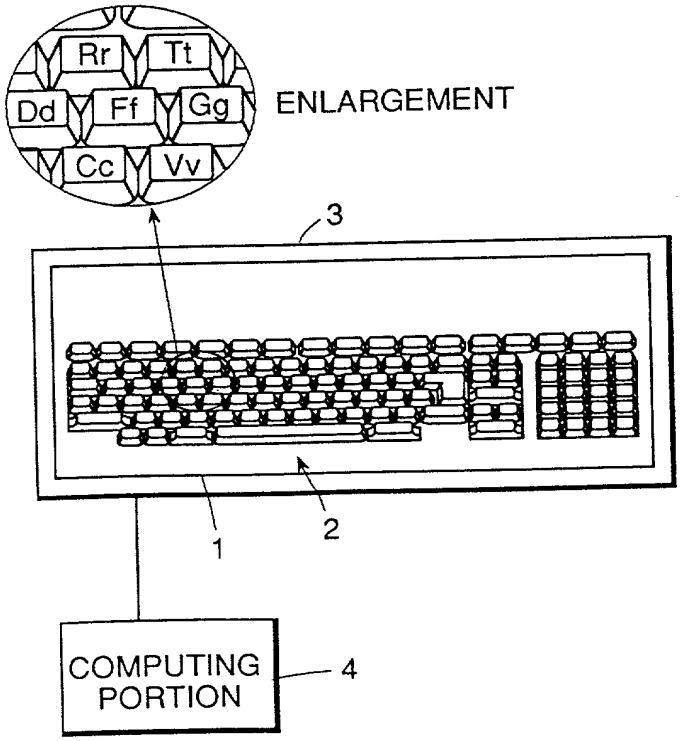

Rr
Tt
Dd
Ff
Gg
Cc
Vv
ENLARGEMENT
3
1
2
COMPUTING PORTION
4

FIG.5

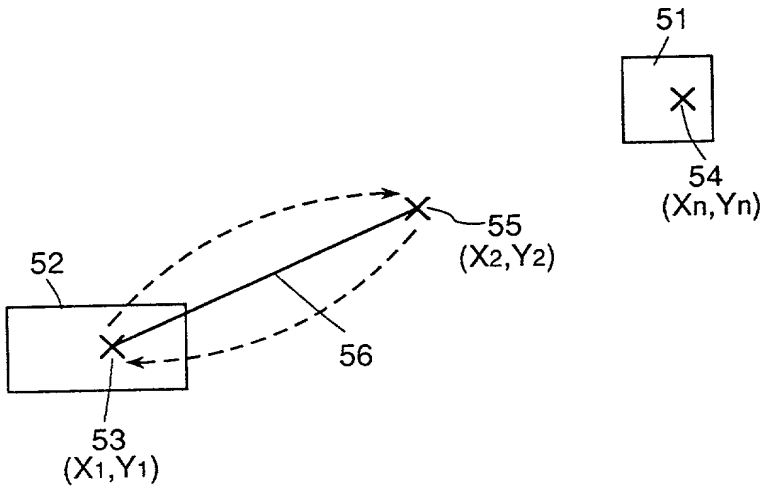
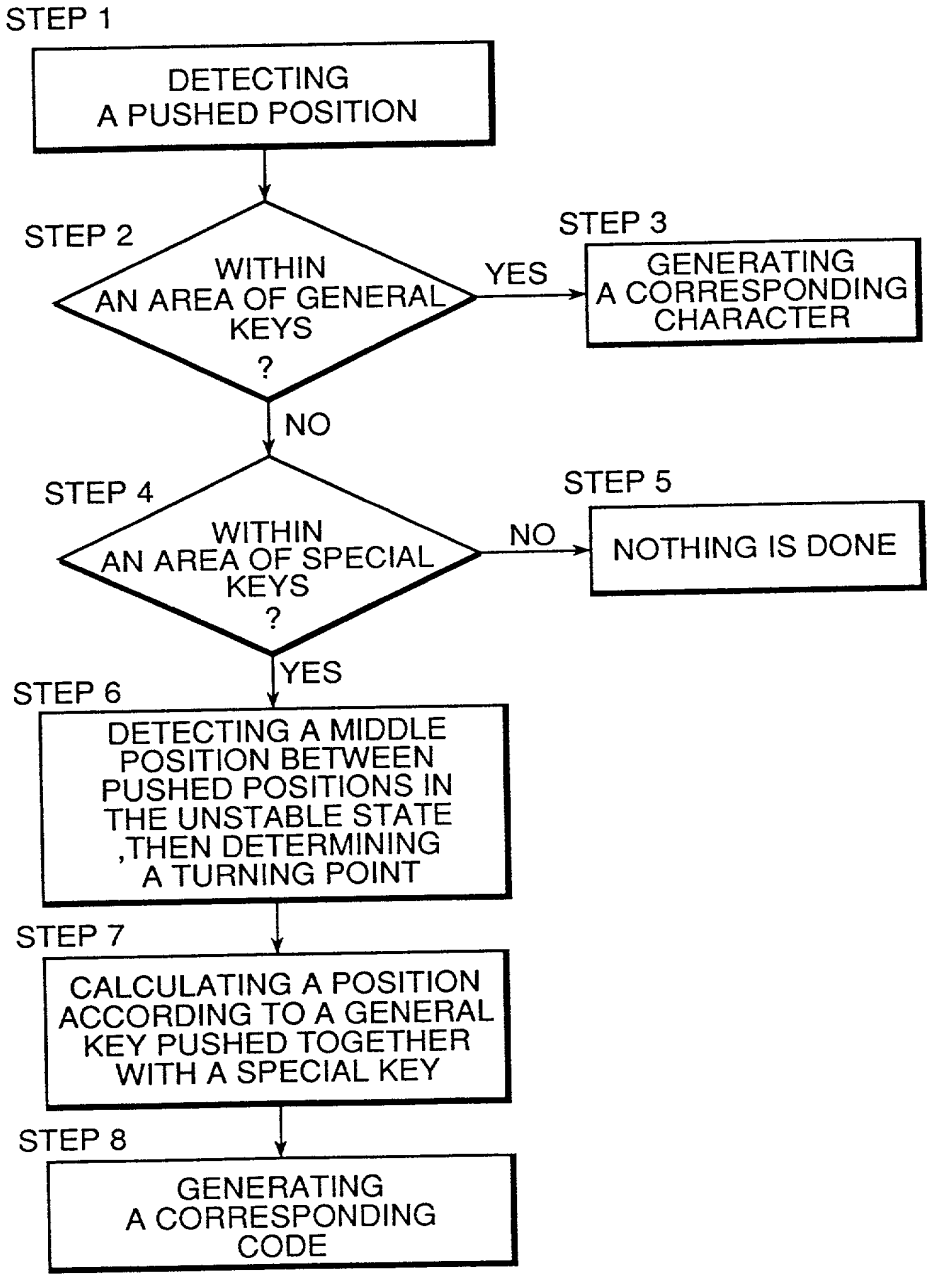


FIG.6


STEP 1
DETECTING A PUSHED POSITION
STEP 2
WITHIN AN AREA OF GENERAL KEYS ?
YES
STEP 3
GENERATING A CORRESPONDING CHARACTER
NO
STEP 4
WITHIN AN AREA OF SPECIAL KEYS ?
NO
STEP 5
NOTHING IS DONE
YES
STEP 6
DETECTING A MIDDLE POSITION BETWEEN PUSHED POSITIONS IN THE UNSTABLE STATE ,THEN DETERMINING A TURNING POINT
STEP 7
CALCULATING A POSITION ACCORDING TO A GENERAL KEY PUSHED TOGETHER WITH A SPECIAL KEY
STEP 8
GENERATING A CORRESPONDING CODE

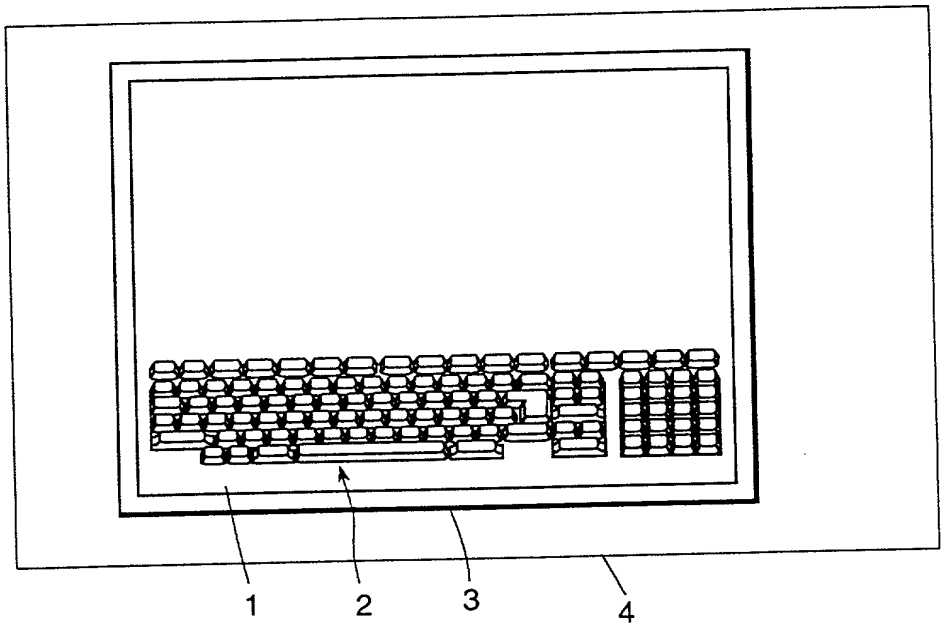



FIG.7